Japan Trip Report

November 26 - December 4, 1982

Lionel H. Olmer

Under Secretary for International Trade

U.S. Department of Commerce

SUMMARY

Japanese high technology industries are advancing rapidly--due largely, but not exclusively, to government direction and support. The government has chosen to promote high technology because of the greater benefits which flow thereby to the entire Japanese economy compared with the benefits that would accrue from promotion of industry generally. Its role is to select target industries, to reduce risks, and to facilitate large scale economies in research, development and production. The process for achieving these goals is for MITI to work closely with industries to identify promising technologies, to establish cooperative research programs, to select a leading foreign company as a model, and then to foster protection of the domestic market. This kind of support develops a strong base from which the chosen firms can launch aggressive export drives.

This report notes that the process is working in biotechnology, robotics, carbon fibers, computers, semiconductors and aerospace. Beyond financial assistance, MITI support brings many additional benefits, including prestige and enhanced cooperation from related industries, private banks and other government agencies. Japan's industrial policy is not a transient phenomenon; the government and the private sector should be expected to continue their determined pursuit of world market share in high technology industries.

Among many issues warranting greater attention are measures to accelerate equivalent opportunities for American companies to trade and invest in Japan's high technology growth; means by which the injurious effects of target industry practices can be effectively dealt with; the ways in which military coproduction arrangements with the U.S. hasten the success of Japanese commercial interests; and the potential impact on the Japanese "information" industry and markets worldwide resulting from the conversion of Nippon Telegraph and Telephone Public Corporation to a profit-oriented company.

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There are factors which limit Japan's success and its prospects: their researchers still look to the U.S. as the pathfinder of new technologies; continuing open access to foreign markets is absolutely essential; and, despite the priority objective in MITI's "Vision for the 80's," of improving the quality of life in Japan, major problems exist in the congestion of the cities, the aging of the work-force, and the emerging competitiveness of commercial rivals in South Asia.

Yet, it must be said that notwithstanding these problems, Japanese businessmen have formidable entrepreneurial skills, a high quality labor force and an international perspective on the importance of being a power in world markets. Combining these advantages with government support makes Japanese high technology companies the number one competitors for their American private sector counterparts.

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PURPOSE

During the period November 26 to December 4, 1982, I visited Japan for the primary purpose of enabling me to better understand the mechanisms by which the Government targets high technology sectors for development, and the means by which government and industry cooperate to create and execute these policies.

The views expressed herein are personal and are not intended to reflect conclusions as to trade policy or as to trade law. However, the lessons learned and the implications for U.S. policies will be examined in greater detail with other officials in the hope that these insights can contribute to the solution of problems in U.S.-Japan trade relationships.

I toured a number of leading companies and talked with private buisinessmen and with officials responsible for Japan's industrial policies. My focus was on those industries and technologies which have been publicly identified by the Japanese government as warranting high priority for rapid development and surrounding which have been organized various "target-industry" programs to accelerate the process. These sectors include: computers, telecommunications and semiconductors, fine ceramics, composite materials, robotics, machine tools, aerospace, and biotechnology.

Appreciation must again be expressed for the open, frank and friendly attitude of all the Japanese people I met with. The tradition of hospitality was exceeded only by their eagerness to explain Japan's impressive achievements in high technology and their optimistic projections for the future.

OBSERVATIONS

Japanese industry excels across a broad range of high technology sectors and is advancing rapidly. Its achievements up to now and the necessarily optimistic projections for future success could not occur without the financial, political and intellectual support of the government, whose influence permeates virtually every sector, albeit in varying degrees.

The government's reasons for targeting high technology relate directly to its perception of the extraordinary contributions which accrue to overall economic performance: high technology industries are more likely to lead to rapid growth and to the creation of new jobs; they are less dependent on scarce natural resources and have fewer adverse environmental consequences; they have significant "forward and backward" linkages throughout other sectors of the economy; and they provide substantial productivity improvements to many, often unrelated, manufacturing and service industries. Thus, "high technology" has the potential for making all of Japan's industries more competitive.

On the other hand, Japan is not yet a technological giant. There are a number of limiting factors in its system, including a dependence on foreign relationships (for technology but more importantly, for access to markets for its products). In addition, Japan lacks a large broad scientific base and its university system remains detached in large part from industrial technology. For example, the objective of creating a $4 billion, government-sponsored "Science-city" at Tsukuba (90 minutes by train from Tokyo; often five hours by auto, although no more than 50 miles distant), which was begun 8 years ago, remains a largely unfulfilled dream. No major corporation has established a facility there; several government agencies have refused to relocate; relatively poor primary schools in the vicinity mean that the working parents will frequently prefer to commute from Tokyo rather than live "on campus" at the risk of reducing their children's competitive chances for admission to a top university.

The major function of government support is to select, or to guide the selection of, technologies to be targeted; to reduce the economic risks normally associated with developing new technologies, and to assist companies to achieve large scale production (and thus to reduce costs) which then permits aggressive international competition. Some examples will be described in subsequent sections of this report.

The direct financial support provided by the Japanese government to targetted industries is in many instances less important than the fact that the industry has been singled out by the government as a

"target" sector. There are tangible and intangible benefits which flow to such companies. Private banks are more willing to extend credit. Prestige and public respect attaches to being part of a priority government program. Customers and suppliers will tend to give preferred treatment. Government officials in various agencies are likely to be more responsive to the particular needs of targetted companies.

Yet, it would be misleading to assign all credit for the success of the Japanese high-tech industry to the direct role of the government. There are some firms and businessmen whose success would be likely in almost any environment -- indeed, whose independence from and antipathy toward "government" is as great as that of the archetypical entrepreneur from America's Silicon Valley.

Japan's commitment to high technology development is not transient. It is independent of political party or factions and is not likely to be diverted because of cyclical downturns in the domestic or international economies. There is a deep conviction that Japan's future economic security is inextricably linked to the commercial success which will result from the high technology target programs. Moreover, international marketing strategies of Japanese companies tend to ignore economic conditions in foreign targeted markets in their press to achieve controlling market positions in selected product lines. Thus, superior performance in reaching national and company goals is at the same time a major cause of growing enmity now confronting Japan in the international community.

Japan's business and government leaders still perceive the United States as the unquestioned leader in basic science and as the pathfinder to be followed by Japanese high technology firms looking to develop and exploit commercial opportunities. The activities of certain American scientific institutions and private company research centers tend to confirm in many Japanese minds the importance of particular technological pursuits ("If Bell Labs is working on this, it must be worthwhile"). Moreover, U.S. made semiconductors and electronic test equipment were in evidence in many government labs and company facilities and were acknowledged to be either superior, unique or at least equivalent to products of local origin.

The contribution which a number of existing military co-production programs launched several years ago by the United States with Japan have made to Japan's international competitiveness in non-military areas is not clear. Yet, it seems evident that the transfer of technology and manufacturing skills which are associated with sophisticated defense systems, such as the F-15 fighter aircraft, the P-3C Anti-submarine Warfare (ASW) patrol aircraft and assorted missile systems, must be facilitating Japan's entry into the commercial aircraft and space systems businesses. Because economies of scale will not be achievable in the case of the F-15 and the P-3C

(only a limited production run is anticipated), the cost of manufacture is about 2-1/2 times the cost of purchasing the assembled product directly from the U.S. manufacturer. It would seem reasonable, therefore, to impute at least some commercial motivation to Japan's enthusiasm for co-production projects.

Nippon Telegraph and Telephone (NTT), a quasi-government monopoly responsible for all domestic public telecommunications and of enormous influence in technical standard-setting throughout the information industry, is in the process of administrative reform with the ultimate objective of becoming a private organization. NTT now has approximately 300,000 employees and an annual procurement budget of more than $3 billion, most of which is awarded to a select few Japanese electronic firms. The prospective conversion to a profit-oriented company (modeled substantially after the Bell System reorganization which is currently underway), will have profound effects on the competitiveness of Japanese companies as well as on the ability of foreign manufacturers to supply NTT and to sell elsewhere in the Japanese market. More Japanese companies will be encouraged to vie both for NTT's business and for the private telecommunications market previously controlled by NTT and its select family of suppliers. It may well encourage Japanese companies to produce for export components of "information systems" with potential military applications, whether or not they are so intended. These developments may pose difficulties for those few Japanese companies which have been relying on NTT's assured purchases to recover R&D costs and to help defray costs attendant on aggressive pricing strategies in foreign markets.

Despite an agreement with the U.S. to accord American manufacturers an opportunity to compete for NTT's annual procurement contracts, there have been few successes. Many companies have been scared-off by the formidable complexities of satisfying NTT's technical procedures, and those who have tried experience frustratirg and costly delays with as yet no large-scale return. There is no doubt of the policy-level commitment by NTT to open its purchases to foreign suppliers; to link up with foreign technology leaders; and, overall, to encourage competition among Japanese companies as well as between them and foreign companies. But the process of changing the attitudes of mid-level officials in NTT's enormous bureacuracy is not easy; and some U.S. companies are suspicous of NTT's desire for technology agreements, partly because they are doubtful that secrets can be kept from Japanese private companies.

Moreover, most foreign suppliers are unwilling to submit to the NTT process of "design-specifications" since this often involves intensive participation between the customer and supplier from the earliest stages of product design through operational test and evaluation. After a product has been introduced to the market by this process it is extremely difficult for a new manufacturer to break-in, either by starting from scratch or by modifying to NTT's

specifications an existing company product which performs identical functions. With no assurance of ultimate purchases, and with the apprehension that one's presence is unwelcome to begin with, U.S. companies must see this as a very risky endeavor. NTT has thus far been unresponsive to requests that it modify its system in this respect by requiring instead "performance standards" as the system by which it measures the acceptability of products, a system already used in much of the world's telecommunication markets.

To achieve sizable sales in NTT's market it will take a more vigorous commitment to the retraining of NTT's bureaucracy at the level of standard setting, performance review and procurement practices; and sustained monitoring of the process by the U.S. government. In the absence of either factor, U.S. companies -- even those whose world class competitiveness is not open to challenge -- will have a difficult decision as to whether to risk substantial outlays over a protracted period in the attempt to penetrate NTT's procurement.

Much has been written about Japan's apparent lack of creativity and its historic dependence upon Western scientific discoveries which Japan has applied to commercial product development. This overlooks the kind of creativity that comes of incremental improvement. Reminiscent of Edison's definition of genius ("99% perspiration and 1% inspiration"), and while not as dramatic as the "blinding flash of insight," it can be just as important.

THE IMPORTANT ROLE OF THE JAPANESE GOVERNMENT IN HIGH TECHNOLOGY

The following types of assistance which are provided by the Japanese government are presented to clarify what may be a mystery to some and appear as "Japan Inc." to others. They are based on observed success stories in Japanese industry. The primary government instruments are the Ministry of International Trade and Industry (MITI) and the Ministry of Finance (MOF).

1. A new technology is demonstrated or described in technical literature outside of Japan and is spotted by MITI and/or elements of Japanese industry. MITI and industry engage in extensive discussions and arrive at a consensus on the most promising areas for commercial application. For example, the feasibility of ceramic automobile engines appeared in an article published in a British journal about 15 years ago but apparently stirred little interest in the West. It was the Japanese who pressed ahead. During this trip, I drove the world's first ceramic engine car on the grounds of KYOCERA Corporation which has recently introduced an experimental model. It began the project with a subsidy from MITI equal to 50% of direct costs. To my knowledge no other manufacturer--and certainly not the British who first conceived of

the idea--is close to having a working unit (although ceramic parts are manufactured elsewhere). Components for diesel automobiles are now being sold domestically and internationally by KYOCERA. More are being planned for introduction in the future. The advantages are lightweight, no-wear and vastly improved thermal efficiency. A ceramic engine will potentially reduce energy consumption by 30%. It is anticipated that ceramic parts--including turbine blades--will be usable in ships and aircraft, eventually.

2. MITI establishes cooperative research programs with funds channeled to a selected company or companies and, with MOF's cooperation, establishes other financial benefits such as special tax depreciation incentives. MITI also serves as a major technical and commercial intelligence collection, analysis and dissemination center. This is especially valuable for smaller companies. Technical labs, some under MITI control and others such as NTT research centers, often share with individual companies information which is intended to reduce the risk and time normally attendant on developing new technologies. For example, NTT is sharing know-how on the development of the 256K RAM semiconductor with a select few Japanese companies (a potentially enormous benefit) and has underway a series of research program in related fields.

3. A target company such as IBM, Du Pont, Boeing or Cray Research (for the "super" computer, which is now a special target) may be chosen as the standard against which the performance of Japanese companies will be measured.

4. In the absence of a Japanese product, Japanese firms will buy foreign products. But there is a strong tendency to buy locally manufactured goods or to substitute as soon as possible domestically produced products for foreign. This means that when the product is initially developed or while the technology is being developed, there will likely be formal or informal protection in the domestic market. During this period MITI and the industry remain in frequent contact regarding emerging plans and activities.

5. Usually, the Japanese companies selected are large and diversified. Once they have developed their capability through this government sponsored program, they launch aggressive export drives in the international marketplace.

An example of this process is the semiconductor and computer industries. Basic semiconductors and integrated circuits were initially developed in the U.S., and the commercial significance was quickly spotted by MITI. But MITI realized that in order to "catch-up", not only would Japanese companies require assistance, they would need to be "collectivized" to accelerate technical development. Thus MITI organized the VLSI (Very-Large-Scale-Integration) program to propel the Japanese industry up to and beyond U.S. levels. There were three groups of companies, all large, including such giants as

Hitachi, NEC, Toshiba and Fujitsu, which were given substantial financial assistance, tax relief and de facto exemption from the anti-monopoly laws. The VLSI program has yielded over 1,000 patents. American companies were eventually granted licenses on many of these patents, but only after a very difficult and protracted period of negotiation. The Japanese semiconductor industry today is acknowledged to be second to none.

The frequency of contact between government officials and company executives merits comment. The most striking element is that the company believes it has an obligation to inform, even to educate, the government on its activities so to ensure that measures designed by government to promote the industry's development will be most advantageous. There is also a degree of implied government authority remaining from the days (prior to 1980) when permission was required from MITI and MOF to transfer technology abroad (through cross licensing arrangements) or prior to acquiring a financial interest in a foreign company.

Although no longer legally required, several company executives acknowledged that their company still "informs" MITI before undertaking one of these activities; whether this is done out of habit or obligation or prudence to avoid the risk of offending a potentially helpful government agency, is unclear. Since, especially for the large, diversified companies, contact with government agencies will occur on a number of issues, this suggests that they continue to informally review their future activities with government officials out of a sense of prudence.

Interestingly, following MITI's relaxation of legal controls on technology transfer, a new system has been put in place which gives the government de facto control anew: patents which result from research programs sponsored by the government become the exclusive property of the government or are jointly owned with the private companies. Thus, MITI is again empowered to limit technology sharing.

OTHER IMPORTANT FACTORS

1. Entrepreneurial skill is alive and well in Japan, despite popular wisdom to the contrary. New product development, new manufacturing processes and cost-cutting efficiencies abound across widely differing technologies.

   -- On the F-15 line, a crane-like device lifts, suspends and turns the fuselage in mid-air while the assembly crew listens carefully for rattles. A useful process, apparently not duplicated in the U.S. counterpart F-15 production line. (But the process was initially conceived and used by the Grumman Aircraft Corporation.)

-- Tools and parts are neatly stacked and accounted for by each individual on each work shift. An American time and motion study a few years ago revealed that in certain assembly operations only 26% of an employee's time is directed towards accomplishment of the objective. Most of the balance is given over to "looking for the right tool or part." With the simple addition of a wooden cart and worker discipline, the 26% has been increased three fold.

2. The high quality and flexibility of the Japanese labor force has taken on almost legendary proportions, and I observed nothing which would significantly diminish this image.

-- Recognizing the just emerging world class competitiveness of Kyoto Ceramics, its labor union approached management in 1978 at the time of serious oil price increases to suggest a wage freeze in order to help the company's efforts. The company now supplies 80%-90% of the world demand for semiconductor housings, shipping nearly 23 million parts per month for over 1000 different semiconductor products. And given that it controls the market, negotiations between KYOCERA, as it is now called, and U.S. semiconductor manufacturers are not marked by price cutting offers to attract the customer, since the Americans are without an alternative. KYOCERA is also the world's leader in the introduction of ceramics parts for diesel engines.

-- Basic worker compensation is low by U.S. standards. Approximately $5,500 a year, is the salary for high school graduates doing semi-skilled work and this is offset by a partially tax deductible room and board allowance provided for bachelor workers; no paid vacations in the first year; and a bonus system worth six months wages given in profitable times, less in hard times. Some firms rely substantially on part-time employees, identified as such even if they work up to 36 hours per week, who receive roughly $2 an hour and who can be laid off without obligations if business conditions require.

3. Individuals in Japanese high technology companies--executives as well as other employees--think in world market terms and seem to focus their energies on export objectives. They continually seek ways to improve their international competitiveness; their inventory control practices illustrate the point. The "Just-in-Time" delivery system is designed to reduce inventory costs to the bare minimum (a major machine tool builder said it keeps less than one week of supplies on hand--inventory serves to "steal from the cash box" the chief executive told me); but it must place enormous demands on supplier discipline and loyalty. Given the incredible traffic congestion in every major city and especially in the three large industrial centers

(Tokyo/Yokohama; Osaka/Kobe; Nagoya), there must be a very high reliance on dispersal of suppliers throughout each region.

4. Beyond the influence of the government and the inherent capabilities of Japanese companies, there are structural factors which make it difficult for foreign companies to penetrate the Japanese market. These have little to do with Japanese Government measures or overt barriers to trade, but they nevertheless serve to make trade difficult. For example, the lifetime employment system in Japan means it is difficult for foreign companies to find skilled employees when they try to enter the Japanese market. The distribution system is complex and therefore encumbers a newcomer in obtaining rapid introduction of his products (there are nearly three times the number of "middlemen" between manufacturer and customer in Japan as in the U.S.). This of course gives competitive Japanese companies time to react. Acquisition of established companies in Japan, which might be used to solve these problems, is very difficult for foreign firms because of barriers to direct investment, although this does appear to be easing somewhat.

SELECTED HIGHLIGHTS OF JAPANESE HIGH TECHNOLOGY ACTIVITIES

1. Japan's biotechnology industry is highly fragmented today with the likelihood that within the next few years a major reduction will occur in the number of active companies (from 2,000 down to 30, according to one source). Enormous commercial potential is foreseen in the medium term (5-10 years) from the introduction of new products and genetic engineering processes. But at present, the strategy seems to be to promote technological cooperation with the U.S.--licensing fees are more important than product sales--and major (commercial) value is expected from the large number of Japanese scientists who have been studying and working at the U.S. National Institutes of Health (NIH) where the federal government has been funding major programs in areas such as cancer research. (There are currently well over 100 Japanese scientists studying and working at NIH.)

In this area of technology, some parts of the Japanese Government act as a hinderance to progress: it can take as long as ten years from inception of a new idea for a pharmaceutical product to its final approval by the Ministry of Health and Welfare, and this problem is becoming more, rather than less severe. Moreover, this ministry is apparently suppressing the price of pharmaceuticals which also has the effect of inhibiting product development since profit margins are reduced and thus new R&D is retarded. It must be anticipated that over the next few years, technologies developed at NIH will lead to hundreds of new products--even perhaps new industries, and that Japan will be at the forefront of this emerging field.

2. As is widely known, Japan is pressing to dominate the world market for robots which it expects to grow at a 30% annual rate for the next decade. There are currently 2 1/2 times the number of robots in use in Japan as in the U.S., and major U.S. manufacturers (the source of the first industrial robots) are linking up with Japanese companies who will provide major systems to the Americans. Japan plans to export about 20% of its robot production by next year; it has provided substantial tax incentives to users of robots in Japan in order that domestic manufacturers rapidly acquire cost-cutting skills which will enable them to out-sell foreign competitors. The U.S. should be the major market for robotics (70% of machine tools in the U.S. are over 10 years old, thus providing a "greenfield" opportunity for robotics in the replacement of plant and capital equipment). In the related field of flexible manufacturing systems (FMS), the leading firm (which exports two-thirds of its production) claims that in a 5 year period of use, FMS will yield 12 times the return on investment of a conventional machine tool factory. Remarkably, this firm developed its own software rather than turning to an outside computer company even though this required 100,000 manhours.

3. Carbon fiber technology is said to be coming of age, and indeed the U.S. space shuttle and the Boeing 767 both use materials reinforced with carbon fibers in secondary structural elements. There is little doubt in the scientific community that, in the not too distant future, composite materials will be applied to primary structural elements (wings made of carbon fibers!).

The U.S. is and will be the largest market for carbon fibers; 2/3 of the world's annual production of 1,200 tons is now purchased, with demand increasing four fold and growth projections of a similar order over the near term.

Although Britain is credited with inventing carbon fiber technology, two Japanese companies are the world's leaders today. They license technology to foreign companies for the production of the materials. MITI provided low/no interest loans for pilot plant construction in Japan because of the risky nature of the venture and expects to be repaid when and if commercial returns are realized. The probabilities are high that lender and borrower feel secure about the future.

4. Much has been written about MITI's program to spur on development of the "5th Generation Computer", a computer which would imitate the way humans think. In Japan great prestige adheres to those companies which are part of this program, although individual research scientists and corporate leaders have serious doubts that the stated objectives can be achieved in the 1990s. Notwithstanding these reservations, all are pressing very hard to contribute, partly because it is a national priority but more importantly because they believe that the efforts will produce many tangible, derivative

benefits in the field of electronics and in related manufacturing processes. Thus, major investment is being made to develop and commercialize the one million bit memory computer chip and to invent new processes and materials necessary for "intelligent" computers. (NTT's laboratory work on Josephson junction technology and galium arsenide as a substitute for silicon are current examples, but it is apparent that other far-reaching work is taking place as well). The experiences gained in this government sponsored program will directly and significantly benefit the competitive aspirations of Japanese companies in their drive for increasing market shares in the world's market for telecommunication and computers as well as semiconductors.

5. MITI is preparing to issue in 1983 a guideline report on the long range future for Japan's civil aircraft industry, which will include budgetary support for the promotion of this sector into the 21st century when it is intended to be fully competitive with European manufacturers and to an extent with some U.S. manufacturers. The preliminary report notes present limitations in technical capacity, sales, marketing and servicing skills and identifies the means by which these deficiencies are to be overcome with government help. Civil aviation is confirmed as a knowledge intensive industry and placed in a class with electronics and biotechnology whose intrinsic and derivative importance have high value to the entire Japanese economy.

CONCLUSION

Japan's success need not be at the expense of America's failure or at the cost of serious injury to U.S. industry. The rapid evolution of Japan's economy, towards the creation of a "knowledge intensive" society and the building of comparative advantage in high technology, carries with it immense potential opportunities. Expanding the number of competitors can accelerate the pace and scope of technological progress in the United States and the rest of the world as well as in Japan. But certain changes will have to occur--on both sides. Foremost, U.S. companies must be given equivalent chances to trade and invest in Japan; secondly we must reduce the economic costs which Japan's industrial policies sometimes impose on U.S. companies. The technological race does not need to be a zero-sum game. Both sides can win, and the results will be of enormous benefit to all.